U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Gardenia remyi*

COMMON NAME: Nanu

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

__X_ Continuing candidate

___ Non-petitioned

_X__ Petitioned - Date petition received: May 11, 2004

__ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1999

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Rubiaceae (Coffee family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Molokai, Maui, and Hawaii

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Molokai, Maui, and Hawaii

LAND OWNERSHIP: This species occurs on State and privately owned lands. One population occurs on lands owned by the Federal Government.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Gardenia remyi* is a tree 3 to 13 meters (m) (10 to 43 feet (ft)) tall; branches quadrangular, puberulent and viscid. Leaves are few, clustered towards the tips of the branches, elliptic to broadly elliptic or obovate, 9 to 24 centimeters (cm) (3.5 to 9.5 inches (in)) long, 5 to 10 cm (2 to 4 in) wide, with the upper surface glabrous and the lower surface dull. Flowers are fragrant, solitary, and terminal with a narrowly funnelform hypanthium, and a white corolla that is six- to eight-lobed. Fruit are orange, subglobose to broadly ellipsoid, and 1 to 2.8 cm (0.4 to 1 in) in diameter. Seeds are irregularly obovate, 1.8 to 2.1 millimeters (mm) (0.07 to 0.08 in) long (Wagner *et al.* 1999a).

Taxonomy *Gardenia remyi* was described by H. Mann. This species is recognized as a distinct taxon in Wagner *et al*. (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat Typical habitat is mesic to sometimes wet forest at elevations between 60 and 760 m (197 and 2,493 ft) (Wagner *et al.* 1999a).

Historical and Current Range/Current Status *Gardenia remyi* is known from several populations totaling a few hundred individuals on the islands of Kauai, Molokai, Maui, and Hawaii (Dave Lorence, Ken Wood, and Steve Perlman, National Tropical Botanical Garden, pers. comms. 1996; Art C. Medeiros III, Biological Resources Division, U.S. Geological Survey, pers. comm. 1996; Hank Oppenheimer, Maui Land and Pineapple Company, pers. comms. 2004 and 2005; Ken Wood, National Tropical Botanical Garden, pers. comm. 2005). While we do not know the long-term population trends of this species due to lack of historical data, it is reasonable to assume the populations have continued to decline, since not all of the threats are being managed throughout of its range.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. This species is threatened by feral pigs (*Sus scrofa*) and goats (*Capra hircus*) that degrade and destroy habitat (D. Lorence, K. Wood, and S. Perlman, pers. comms. 1996; A. Medeiros, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat. Pigs are currently present on all the islands where *Gardenia remyi* occurs, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Cuddihy and Stone 1990; Wagner *et al*. 1999a).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, and Hawaii. Goats browse on introduced grasses and native plants, especially in drier and more open ecosystems. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al*. 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). This species is now vulnerable to the long-term, indirect effects of goats, such as large-scale erosion. The habitats were damaged in the past by goats, and these effects are still apparent in the form of alien vegetation and erosion.

Pig and goat exclusion fences protect the west Maui populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Pigs and goats eat leaves and other parts of this species (D. Lorence, K. Wood, and S. Perlman, pers. comms. 1996; A. Medeiros, pers. comm. 1996). Pig and goat exclusion fences protect the west Maui populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

D. The inadequacy of existing regulatory mechanisms.
Goats and pigs are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers. Pig and goat hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Lands and Natural Resources n.d.-a, n.d. b, n.d.-c, n.d.-d). Public hunting does not adequately control the number of ungulates to eliminate the threats to native plant species. Pig and goat exclusion fences protect the west Maui populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.
Alien plant species threaten this species (D. Lorence, K. Wood, and S. Perlman, pers. comms. 1996; A. Medeiros, pers. comm. 1996).

Although the exact pest species that threaten this plant have not been identified, alien pest plants are found throughout the areas where this species occurs. The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Confirmed personal observations (D. Lorence, K. Wood, and S. Perlman, pers. comms. 1996; A. Medeiros, pers. comm. 1996) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *Gardenia remyi*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the mesic to wet forest habitat of *G. remyi*, the Service believes nonnative plant species are a threat to *G. remyi*.

Nonnative plants are being controlled in the west Maui populations of this species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Currently, many widespread alien plant taxa cannot be completely eradicated from Kauai, Molokai, Maui, or Hawaii, and therefore

are expected to continue dispersing into previously managed areas (Loope 1998, Smith 1985). The remaining unmanaged populations of *G. remyi* are still impacted by this threat. This species is represented in an *ex situ* collection.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The West Maui Watershed Partnership, a non-governmental, non-profit partnership composed of west Maui landowners and managers, received funding from the Service from 2000 to 2004 for ungulate exclosure fences, and ungulate and nonnative plant control (Maui Pineapple Company, Ltd. 1999). The partnership has completed construction of the fences. The Service provided funding in 2005 for additional fences. Nonnative plant control is ongoing. In the summer of 2004, the State Division of Forestry and Wildlife began construction of an ungulate exclosure fence in the Kahakuloa Game Management Area. All of these actions are expected to benefit the individuals of *Gardenia remyi* that occur in these areas.

This species is represented in an *ex situ* collection (Volcano Rare Plant Facility) and initial attempts have been made at reintroduction or population augmentation (U.S. Fish and Wildlife Service Controlled Propagation Database 2005).

SUMMARY OF THREATS:

The major threats to this taxon are pigs, goats, and nonnative plant species. Feral pigs have been fenced out of the west Maui populations where *Gardenia remyi* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the populations that are fenced. These on-going conservation efforts for this species benefit only the west Maui populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:
Magnitude:
This species is highly threatened by pigs and goats that directly prey upon, degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Threats to mesic and wet lowland forest habitat of *Gardenia remyi* and to individuals of this species occur throughout its range, and are expected to continue or increase without control or eradication. Feral pigs have been fenced out of the west Maui populations where *Gardenia remyi* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in the populations that are fenced. These on-going conservation efforts for this species benefit only the west Maui populations. The other populations of this species are still impacted by these threats and will require long-term monitoring and management to maintain threat free areas. This species is represented in an *ex situ* collection.

Imminence:
Threats to *Gardenia remyi* from pigs, goats, and nonnative plants are imminent because they are ongoing in the unfenced populations.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?
No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the Service has funded conservation actions that will benefit *Gardenia remyi*, including ungulate exclosures, and ungulate and nonnative plant control in the west Maui mountains; and, fencing in the Kahakuloa Game Management Area. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *G. remyi* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:
Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Arthur C. Medeiros III of U.S.G.S. National Biological Discipline in 1996 and Steve Perlman and David Lorence of National Tropical Botanical Garden in 1996. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. New information on status and range was provided by Hank Oppenheimer in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of

Gardenia remyi was provided by Hank Oppenheimer, Maui Land and Pineapple Company and Ken Wood, National Tropical Botanical Garden.

Species experts have provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED
List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer*	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	March 29, 2005	National Tropical Botanical Garden
9. Ken Wood*	August 2, 2005	National Tropical Botanical Garden
10. Marie Bruegmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004
2. U.S. Fish and Wildlife Service Controlled Propagation Database	2005

Other resources utilized:

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

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Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.

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Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.

Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

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Stone, C.P. 1985. Alien animals in Hawai`i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *in* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 251-297.

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Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21(1): 1-16.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai`i, Bishop Mus. Spec. Publ. 97: 1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.

Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Mus. Occas. Pap. 60: 1-58.

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Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/16/05
Regional Director, Fish and Wildlife Service Date

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: September 16, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 22, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 14, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 14, 2005
Field Supervisor